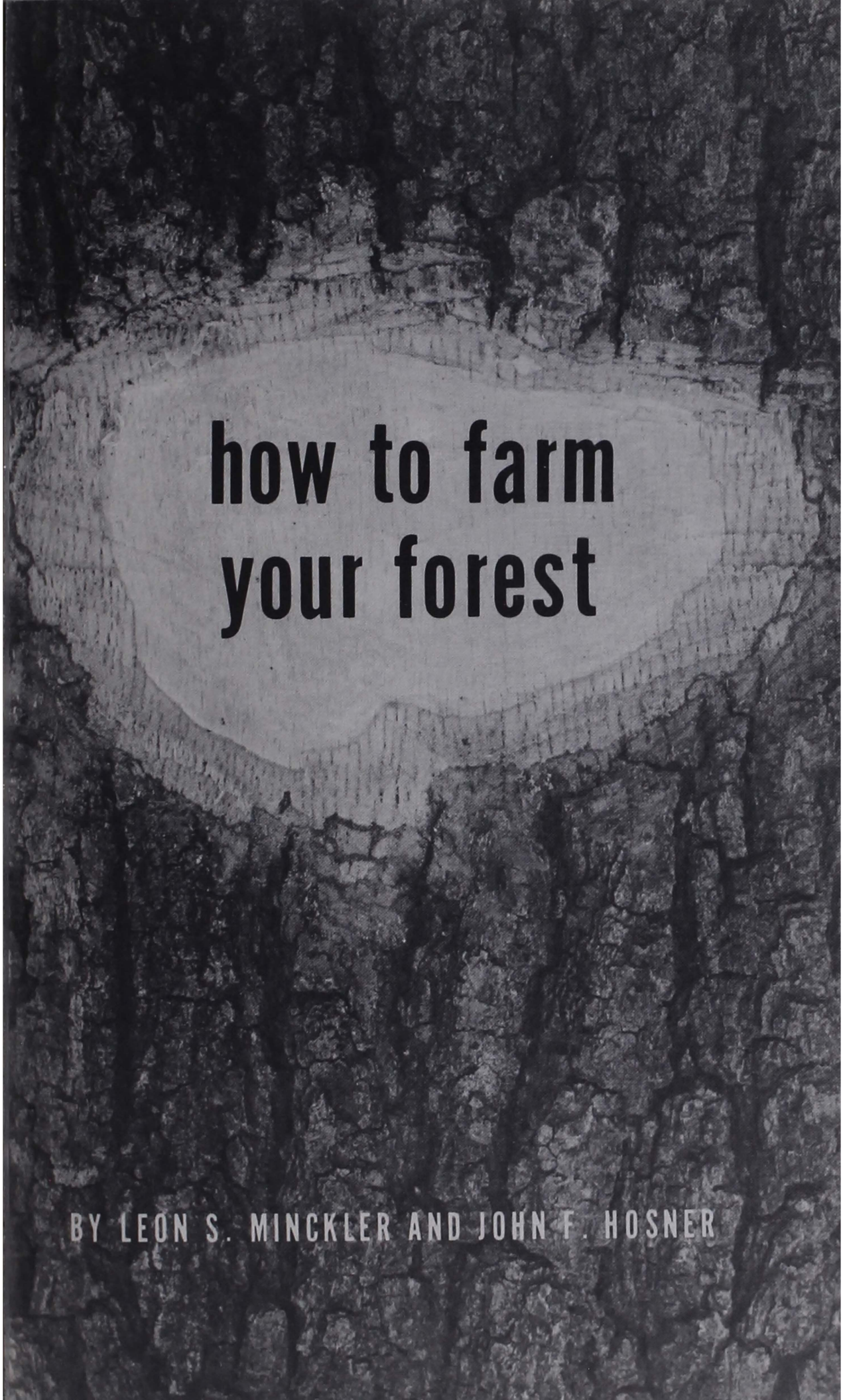
how to farm
your forest
BY LEON S. MINCKLER AND JOHN F. HOSNER

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A GUIDE FOR WOODLAND OWNERS IN SOUTHERN ILLINOIS

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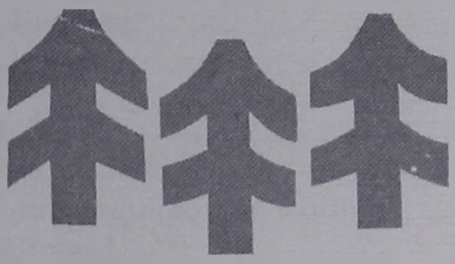

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WHY MANAGE YOUR WOODLANDS?

Farm woodlands are usually the areas left after the better land is used for other crops. In southern Illinois this "left over" land makes up more than a fourth of the total land area. Most of it—because of topography, flood susceptibility, or for other reasons—is best suited for timber growing. This land is a part of the farm and should provide an income for the farmer.

The objective of most farmers is a good, steady income combined with the best current living for the family. The farm woods can play an important part in meeting this objective. A farmer should apply what labor and materials he has to his woodland the same as he does to the rest of the farm. Perhaps all farmers cannot profitably use their labor and equipment in the woods, but most of them can apply better management and get greater returns from their woodland investment than they do. A woodland owner has certain costs such as taxes, depreciation of equipment, and family upkeep which do not change. Why not let the woods help pay these costs, especially when the return per man-hour of labor expended on woods work may be as great as returns per man-hour for cultivated crops?

Timber growing and harvesting can be worked into the whole farm enterprise. If the owner does not wish to do his own harvesting, growing trees can still be profitable. Actually, trees are just as much an investment as cattle and can yield up to 15 or more per cent interest depending on the type and condition of woodland and how the owner manages it. Not only are growing trees a good investment from the standpoint of the interest earned, but also from the standpoint of capital growth. Prices paid for standing timber in the United States have been going higher and higher. There is every reason to believe that this trend will continue.

Why then do not more woodland owners practice good forestry? Some of the answers are listed below:

1. Although the return on the money and labor invested is good (in comparison with cultivated crops) the total return from each acre is low. In this region where the average woodland area is small, the farmer tends to be more interested in other farming than in forestry.

2. Landowners underestimate the returns from practicing forestry on low-value land generally unsuited to other uses.
3. General lack of know-how regarding some easy and inexpensive ways to make woodlands more productive.
4. The occasional need for quick cash which encourages liquidation of timber growing stock.

It is the purpose of this report to describe good woodland management practices and show the return that can be reasonably expected from their application. Specific and simple instructions will be given on "how to farm your forest." Here are the things you will need to know:

1. How to recognize a few classes of trees.
2. How to make your woods grow faster.
3. What trees should be cut.
4. What trees should be killed.
5. How to make your forest reproduce.
6. How to protect your forest property.
7. How to harvest and sell your forest crop.
8. How to build up your forest.

Each of these points is covered in this report.

HOW TO RECOGNIZE DIFFERENT CLASSES OF TREES

The tree classes used depend on a system of classifying individual trees on the basis of quality and their present or potential role in the stand. A detailed description of each tree class is given below. Pictures of typical trees are shown in figures 1-6.

Description of Tree Classes

Good Growing Trees

1. Trunk reasonably staight and free of numerous branches or branch stubs (figure 7).
2. Merchantable trunk length should conform to site quality. Better sites grow taller trees and taller trees usually have more merchantable length. As a rough rule-of-thumb, the usable length should be at least two-thirds of what the site can produce. The tallest nearby trees of about the same diameter can often be used for a comparison.
3. Trunk sound and free of scars, holes, or rotten knots. Healed shallow scars are permitted.
4. Acceptable species for that particular site.
5. Appears to be windfirm and without previous springing of roots (figure 8).
6. Diameter below maturity for the particular species and site.
7. Well-developed, vigorous crown with full foliage and not more than one dead branch larger than 3 inches in diameter (figure 9). A few dead branches less than 2 inches in diameter below the crown are acceptable.

Mature Trees

This class of trees has the same characteristics as good growing trees except that they have reached **maturity** (see chart on page 5). It is not maturity in the sense of old age or approaching death. A tree is financially mature when the value of the annual growth falls below a point acceptable to the owner, often 3 or 4 per cent of the value of the tree. Maturity, of course, varies with growth rate and growth rate is influenced by species, site, growing space, and tree vigor.

The range in diameters given in the chart is to allow for

the vigor of different trees of the same species on the same site. Trees with poor vigor are usually mature when they have reached the smaller diameter given. Trees with good vigor should be allowed to grow to the larger diameter. The usual characteristics for good and poor vigor are listed in the Appendix.

Sound Low-Quality Trees

1. Trunk sound and free of holes and rotten scars and knots which would result in death, breakage, or windthrow.
2. Well-developed, reasonably vigorous crown with no large dead limbs except near the bottom.
3. Appears to be windfirm and without previous springing of roots.
4. Must be merchantable but may have one or more of the following characteristics:
   a. Numerous limbs and stubs on the trunk.
   b. Sweep or crook (figure 10).
   c. A short usable length.
   d. A poor species.
   e. An excessively large crown; a "wolf" tree (figure 11).

Overmature Trees

1. Large, merchantable trees of any species past maturity size.
2. Often contain much butt rot and large rotten branch stubs or holes along the trunk (figure 12).
3. Tree has low vigor as shown by large dead limbs throughout the crown (figure 9).

Defective Trees

Have the same general characteristics as overmature trees above except they are smaller. In general, they are merchantable trees about 15 to 22 inches in diameter that have little or no net growth because of rot and are poor risks to leave in the stand.

Cull Trees

Trees that are so defective, crooked, or poorly formed that they cannot be cut and sold for enough to pay the costs of labor. Detailed specifications for an operable tree are given on page 16. Trees that will not meet these specifications are culls.

GUIDE TO FINANCIAL MATURITY OF TREES EXPRESSED IN TREE DIAMETER*

Site	Species	Cabinet-Veneer Quality Trees	Stave-Bolt Quality (White Oak Only)	Sawlog Trees
Uplands				
Coves, stream margins lower northerly slopes. Breaks along streams in claypan region.	Yellow-poplar Sweetgum White Oak Red Oaks Black Oak	24-28	22-26	20-24
	Black Walnut White Ash	20-24	-----	18-21
Southerly and upper northerly slopes. Rolling land in claypan region.	White Oak Black Oak Red Oak Yellow-poplar	22-26	20-24	18-21
	Scarlet Oak Hickory	-----	-----	17-20
Ridgetops and upper southerly slopes. Flat and less well-drained land in claypan region.	Black Oak White Oak Southern Red Oak	-----	18-22	17-19
	Post Oak Scarlet Oak Hickory Pin Oak	-----	-----	15-18
Bottom Lands				
Well-drained alluvial lands with deep soil.	Sweetgum Red Oak White Oak Yellow-poplar	26-30	22-26	24-28
	Sycamore Silver Maple Cottonwood	-----	-----	22-26
	Ash	-----	-----	18-22
Poorly drained with tight clay subsoil.	Sweetgum	20-24	-----	18-22
	Pin Oak and Other Oaks	-----	-----	17-20

*Diameter of tree trunk in inches at breast height; 4½ feet above ground.

The tree classes just given apply to all tree sizes five inches and larger. Trees are not counted as sawtimber unless they are eleven inches or larger in diameter. Trees from five to ten inches in diameter are pole-sized. They are the future crop trees. In this region they are seldom marketable except occasionally for pulpwood, posts, or mine props. Some can be used on the farm. Good growing poles represent future sawtimber and should be left to grow (figure 13). All other poles are usually a detriment to the stand and should be cut or killed.

HOW TO MAKE YOUR WOODS GROW

The procedure can be outlined rather simply as follows:

1. Harvest now or as soon as possible
   a. Overmature trees.
   b. Defective trees.
2. Harvest now or within abour three years
   a. Mature trees.
   b. Sound low-quality trees.
3. Cut or kill now or as soon as possible; combine with harvest cut
   a. Cull sawtimber-sized trees.
   b. Pole-sized trees that are not good growing stock. (It is not essential to kill small overtopped trees not interfering with good seedlings.)

When all the above operations are completed, only the good growing trees will be left. They will have more room to grow, growth will be increased, and quality of growth will be better because it is being put on only the better trees. The open spaces left in the woods will permit seeding and growth of new young trees (figure 14). In a stand that has had all but the good growing-stock trees removed, it is not unreasonable to expect the growth rate to double or triple during the next five- to ten-year period (figures 15 and 16).

Species to Grow

The best species to grow will depend on the site where they are growing. A simple guide for tree species of southern Illinois is shown below:

SPECIES FOR GOOD GROWING STOCK

Site	Better	Poorer
Uplands		
Coves, stream margins, and lower northerly slopes. Breaks along streams in claypan region	Yellow-poplar White oak Red Oaks Black oak Black walnut White Ash Sweetgum	Maple Beech Hickory Black gum
Southerly and upper northerly slopes. Rolling land in claypan region	White Oak Black oak Red oak Scarlet oak Yelow-poplar Hickory	Maple Beech Black gum Post oak Blackjack oak
Ridgetops and upper southerly slopes. Flat and less well-drained land in claypan region	Black oak White oak Southern red oak Post oak Scarlet oak Pin oak Hickory	Blackjack oak Maple Beech Black gum
Bottom lands		
Well-drained alluvial land with deep soil	Cottonwood Sweetgum Silver maple Sycamore Ash Red oak White oak Yellow-poplar	Elm Willow Pin oak Honey locust Boxelder Hackberry Pecan
Poorly drained with tight clay subsoil	Pin oak Sweetgum Other oaks	Elm Willow Honey locust Hackberry

Figure 1. Good growing tree. The marked oak tree is straiaht, sound, and clean. It has good vigor and high merchantable length for the site. This tree is about 19 inches in diameter and highly salable but should not be cut. For the greatest return to the owner it should be held until it reaches at least 22 inches in diameter.

Figure 2. Mature tree. The marked oak tree is about 22 inches in diameter and is big enough to cut. It is sound and fairly vigorous but the interest return on this tree is less than 4 percent.

Figure 3. Sound low-quality tree. The marked tree is sound but has poor form. It is merchantable and should be cut when the stand is placed under good management.

Figure 4. Over-mature tree. The marked tree is past maturity and should be cut at once. It is still merchantable but losing value rapidly. It is a poor risk to leave in the stand. Contrast this tree with the good growing tree to its left.

Figure 5. Defective low-quality tree. The marked oak tree has a partially dead and rotten crown and rot has progressed part way down the trunk. It should be cut at once while it is still merchantable.

Figure 6. Examples of cull trees: **A (left).** This ash tree is both crooked and rotten. **B (right).** The marked maple tree is badly defective.

HANDLING DENSE YOUNG STANDS

Rather dense stands of young trees below sawtimber size occur occasionally (figures 17 and 18). The most common are:

1. Nearly pure stands of pin oak on upland flats or bottom lands.
2. Nearly pure stands of cottonwood on bottom lands.
3. Mixed stands of silver maple, ash, sweetgum, and cottonwood on bottom lands.
4. Nearly pure stands of yellow-poplar on upland coves and stream margins.
5. Mixed stands of oak and hickory on uplands.

If left alone, the trees in such dense stands will "fight it out" and eventually some will emerge as dominant and others will die. This is wasteful for two reasons: (1) Much wood is lost and (2) the soil's nutrients and moisture are used up by both good and poor trees. This increases the length of time required to grow logs or other products. Rather, you want all the growth to be concentrated on the best trees. This is accomplished by removing or thinning out the unwanted trees. If possible, such trees should be used for pulpwood, posts, piling, mine timbers, poles, fuelwood, or other products. Otherwise they should be killed by girdling or poisoning.

The following general rules for thinning apply fairly well to all types of dense young stands.

1. If usable, cut overtopped or other trees that will soon die.
2. Cut or kill defective or poorly formed trees.
3. Cut or kill trees of poor species.
4. If usable, thin out the poorer of the remaining trees so as to leave about the following numbers of the best sound, straight, and clean trees (figure 19):

NUMBER OF TREES PER ACRE

Species	5-10 Inches D.B.H.
Pin oak	180-220
Cottonwood	220-260
Mixed bottom-land hardwoods	260-300
Yellow-poplar	260-300
Mixed upland hardwoods	220-260

In general, small overtopped trees likely to die anyway may be ignored unless they are usable.

WHAT IS A PRACTICAL CUTTING OPERATION?

We have already discussed the **classes** of trees that should be cut or killed. Now we should consider some of the practical economic questions involved in the actual cutting operation. Here are three questions you will want answered:

1. What is the smallest amount per acre and per woodland you or an operator can afford to harvest? This amount may be different for you than for a timber buyer.
2. What is the poorest tree that you or an operator can afford to cut and sell?
3. How should cull trees be handled and how much will it cost?

What Quantity of Timber is Operable?

If the cut is made as previously described, and only the good growing trees are left, **the initial harvest in sawtimber stands will usually be heavy enough to make the operation pay.** Sometimes, however, the desired cut may be so light that harvesting the trees will not pay. Aside from volume cut, the things that determine whether or not a logging job will pay are (a) quality and size of timber, (b) ease of logging, (c) distance to mill, and (d) selling price.

On most farm woods in southern Illinois, trucks can be driven to within an eighth of a mile of the felled trees and markets are usually within a ten-to-fifteen mile radius. Within these limitations, the following amounts can usually be cut by an operator if normally good markets exist (figure 20). The landowner could probably afford to cut still smaller amounts.

OPERABLE MINIMUM CUT

Product	Per Acre	For Average Woods
High-quality cabinet-veneer logs.	100 bd. ft. or more	300 bd. ft. or more
White oak stave bolts	25 chord ft. or more	100 chord ft. or more
High-quality or large sawlogs	500 bd. ft. or more	5,000 bd. ft. or more
Low-quality or small sawlogs	1,000 bd. ft. or more	12,000 bd. ft. or more

A heavy improvement cut, leaving only the good growing trees, usually will remove from 1,000 to 3,000 board feet per acre in the average sawtimber stand of southern Illinois.

What is an Operable Tree?

Here again operability depends upon ease of logging and accessibility as well as tree size and quality. Under average conditions, an operable sawtimber-sized tree should have at least one merchantable log with the following minimum specifications. If it will not meet these specifications, and if it is not good growing stock, it is a cull tree (figure 6).

OPERABLE SIZE

Species	Log		Tree
	Length (feet)	Diameter (inches)	Diameter (inches)
Yelow-poplar, sweetgum black walnut, black cherry	10	10	12
White, red, and black oaks	8 (tie)	11	12
Cottonwood, silver maple, sycamore, ash, and white, red and black oaks	10	12	14
Hickory, black gum, beech, hard maple, elm, and miscellaneous	10	13	15

Tie logs must be 100 per cent sound and all others at least 75 per cent sound.

If a tree contains at least one of the following products, and markets exist, it can be considered merchantable.

1. Mine props equivalent to at least 12 linear feet of usable material.
2. A mine bar at least 12 feet long and 8 inches in diameter.
3. Three chord feet of white oak stave bolt material.
4. Two ash or hickory handle bolts 40 inches long and at least 8 inches in diameter.

Any cull hardwood tree will make fuelwood or pulpwood, but markets in southern Illinois are very limited. Any of the products listed above must be present in sufficient amount to command a market and to make the cutting economically attractive.

How to Kill Cull Trees

Probably the cheapest way to kill unwanted trees on small woodlands is to girdle them with a sharp ax. This job will usually require about 2 to 3 man-hours per acre. The tree must be **completely** circled and all bark cut and removed at least down to the wood.

If the bark does not slip off easily or if the surface of the tree is irregular, it is better to cut a deep V-shaped notch around the tree (figure 21). If the bark peels off easily, a strip about four inches wide can be removed. However, no uncut strands of inner bark should be left or new wood will bridge the gap and the tree will live. Ordinarily, the deeper the girdle the quicker the tree will die.

There are several good tree poisons on the market and these may be used to advantage under the following conditions:

1. When a quick kill is desired.
2. When the tree is so large or the surface so irregular that a complete girdle is difficult or impossible.
3. When poisoning is cheaper, i. e. when labor costs are unusually high.
4. To prevent or reduce sprouting on smaller trees.

The chief poisons can be purchased almost anywhere on the open market. They are **Ammate,** the "ester" form of **2,4,5-T,** and Brush Killer. Brush Killer is a mixture of **2,4,5-T** and **2,4-D.** The tree should be frilled (figure 22) close to the ground with an ax. The ax cuts should overlap and completely encircle the tree and chips should be left as "cups" to help hold the solution. The poison solution should be poured into the frill so as to thoroughly wet all cut surfaces. Smaller trees can be killed by heavy spraying outside the bark around the base of the tree, using an oil solution of 2,4,5-T or Brush Killer. Concentrations of the chemicals should be according to the directions on the container. Ammate is used in water solution and 2,4,5-T or Brush Killer usually in diesel oil or fuel oil. Ammate is somewhat corrosive to metal. It is also irritating to the skin. Trees can be killed any time of year.

HOW TO START NEW TREES

Seedling trees of the right species must grow to provide new trees as the old become large and are harvested. Young trees also act as "trainers" for the older trees by helping to keep their trunks cleanly pruned. Fortunately, trees usually seed themselves naturally in openings cut in the forest. However, sometimes the poorer species become established first.

Three conditions must usually be met before successful development of new trees takes place: (a) good supply of seed, (b) proper soil and ground conditions, and (c) adequate light. Seed is supplied by leaving some of the larger trees of good species in the woods.

The approximate conditions for germination and seedling development of the good species are shown below.

CONDITIONS FOR GERMINATION AND SEEDLING DEVELOPMENT

Species	Ground	Location
Yellow-poplar, ash	Some exposed mineral soil or only very light litter	Direct sunlight through openings in forest. Openings should be 1/10 acre in size or larger.
Sweetgum, silver maple, sycamore	Damp mineral soil, bare or with light litter	Direct sunlight best but sweetgum will grow under partial light shade
Cottonwood	Wet, bare silt or mud during time of germination	Full, open sunlight is best. Openings should be at least ¼ acre.
White, red, black, scarlet oaks and walnut	Light to moderate ground litter	Direct sunlight through openings in forest is best. Light partial shade tolerated.
Pin oak	Wet, bare soil or with light litter	Full, open sunlight is best. Openings should be at least ¼ acre.
Hickory	Light to moderate ground litter	Will tolerate moderate shade.

The poorer species such as boxelder, elm, maple, beech, blackgum, and hickory will tolerate moderate to heavy shade whereas the better species generally require more light. This is significant because it shows how to separate the good from the bad. To obtain new yellow-poplar trees, the stand must be cut so as to leave open holes (figure 14) and the leaf litter should be mixed up and scraped off by logging and skidding. This is especially helpful if done during the late winter.

In the same way, good growth of new oak seedlings occurs only when there is sufficient open sunlight. The following systems or methods of cutting are considered best to get good growth and to insure a "catch" of new trees.

Upland Hardwoods

Cut heavy enough to leave numerous holes in the stand for entrance of direct sunlight. This can be accomplished by

cutting mature, low-quality, and cull trees, as already described. In high-quality stands with few poor trees, cutting should be concentrated to make holes in the stand about 1/10 to 1/4 acre in size (about 60 to 100 feet in diameter). On good sites suitable for yellow-poplar, special effort should be made during logging to stir up the leaf litter, preferably during January to late March.

Bottom-land Mixed Hardwoods

Heavy improvement cutting will normally leave numerous holes large enough for reproduction. In well-stocked stands, mature trees should be removed in groups to leave openings of 1/10 to 1/4 acre. Short, temporary flooding or disturbance of litter by logging is beneficial.

Cottonwood and Pin Oak

These species usually occur in pure, even-aged stands. The stands should be thinned occasionally and finally the remaining trees taken in one cut, at time of maturity. Cutting in blocks or strips over a two- to three-year period will insure a good seed supply. If conditions are right, the same species will form the next crop, but other species may take over. If the under-brush is composed of such poor species as boxelder, elm and hackberry, it should be destroyed at time of logging, insofar as practicable.

Figure 7. The marked trees show a contrast between a desirable straight tree and a crooked tree. The crooked tree should be eliminated from the forest as soon as possible.

Figure 8. A root-sprung tree. This tree leans badly and is liable to windthrow and loss of vigor. Such trees should be cut if they are merchantable and killed if not merchantable.

Figure 9. The marked trees show a sharp contrast between vigorous and very poor crowns.

A. This tree has a vigorous, healthy crown as shown by its full size and the many fine branchlets.

B. This tree is near death and, if merchantable, should be cut at once.

Figure 10. Tree with sweep. This tree is merchantable and should be cut to make room for straight trees of higher quality.

Figure 11. A "wolf" tree. The marked oak tree has a short trunk and a very wide spreading crown. It occupies much more space than is justified by its value. It is merchantable and should be cut.

PROTECTING YOUR FOREST PROPERTY

Your woodland has four main enemies: (1) fire, (2) livestock, (3) diseases, and (4) insects. Two of these, fire and livestock, are the most easily controlled.

Fires kill young trees, reduce the soil fertility, and scar trees, thereby allowing diseases and insects to enter (figure 23). This type of damage often results in hollow or otherwise defective and cull trees.

Grazing damage, while less spectacular, may be just as severe as that caused by fires. Grazing animals injure exposed roots at the base of trees permitting insects and diseases to enter. Grazing animals also eat young trees, preferring such kinds as yellow-poplar, ash, white oak, and red oak, which are most valuable for restocking. This not only kills trees needed for restocking but eliminates saplings needed as "trainers" to shade the lower part of larger trees. This shading helps produce a long, clean trunk.

Grazing also packs the soil, reduces the leaf litter and lowers the rate of moisture absorption. A Wisconsin study showed that grazing increased water runoff on sloping woodland from 197 gallons per acre to 9,308 gallons during one year. The lower soil moisture results in slower tree growth.

Moreover, woodland pasture is poor fare for cattle. A recent study showed that in a normal year nearly 18 acres of woodland were needed to maintain the body weight of a 700-pound steer during the pasturing season. A similar steer had lost 75 pounds by July 20, on 12 acres of woodland pasture. Grasses grown under woodland shade have less carbohydrates and other nutrients than grasses grown in open pasture.

A small area of woodland may be saved near improved pasture for cattle loafing and protection but the rest should be fenced to keep out livestock. If more pasture is needed, it is better to clear the area necessary and convert it into improved grazing land. **PASTURING AND TREE GROWING DO NOT PROFITABLY MIX ON THE SAME AREA** (figure 24).

A certain amount of insect and disease damage is always present in forest stands. Unless a specific insect or disease attacks trees in large numbers, the loss is more or less normal and need not cause great concern. Usually, these pests become severe in forests already damaged by fire and/or grazing. They seldom are a problem in well-managed forests. Even

Figure 12. Examples of trees with butt rot and rot in the trunk:

A. Butt rot in an ash probably caused by an old fire.

B. The "squirrel" hole in the trunk of this scarlet oak is sure evidence of a rotten center.

C. The rotten hole in this hickory makes it a cull tree.

where some trees are injured they often can be salvaged before loss is very great.

To sum it up, if you expect your woodland to yield a satistactory return year after year, it must not be grazed and it must not be allowed to burn.

HOW TO HARVEST AND SELL YOUR FOREST PRODUCTS

The first question to be settled is: Should I sell forest products at the mill, at the roadside, or as standing trees?

There are a number of things to take into consideration. First, there are labor and material values represented in the rough forest product (sawlog, etc.) at the mill. These vary greatly with the quality of the timber, the type of product, and logging conditions.

Stumpage may be a small or a large part of the value of the rough product delivered to the mill or a railroad siding, as shown in figure 25. For example, if an owner sells standing sawtimber trees, his income will only be 24 to 40 per cent what it would be if he were to sell the logs delivered to the mill. For cabinet veneer logs, however, most of the value is stumpage. Other things being equal, it seems wiser to concentrate your own labor on the lower-valued products such as mine props, pulpwood, and sawlogs, and to sell the higher-valued cabinet veneer as stumpage. Generally the higher valued stumpage can be more readily sold standing in the woods. Also, veneer-log

Figure 13. A stand of good quality young timber. Although of generally good quality this stand needs a thinning to remove some of the poorer trees.

specifications are more exacting and logs can be more easily damaged by inexperienced crews. This makes it more desirable to sell stumpage.

Figure 14. Yellow-poplar reproduction developing in an opening in the forest made by cutting three large trees. In direct sunlight both oak and yellow poplar seedings develop rapidly.

Looking back at figure 25, it is also well to remember that felling, bucking, skidding, and hauling are operations that a farmer can earn money at. If he hires the labor to log, he would still receive a return for his own management. In this case his total return would be greater than a straight stumpage sale.

You should also be aware of another factor in stumpage sales. Although experienced men are good judges of timber quality, many defects in trees cannot be seen until the tree is cut. To allow for these unforeseen defects, buyers usually allow a "risk percentage" for error in judgment. This is the deduction in the stumpage price by the buyer to offset any defects not evident in the standing tree. This "risk percentage," of course, is not necessary when the timber is sold in the log form. This item is important for landowners who have followed good cutting practices and who have kept fire and grazing out of their woodlands. The timber on such areas has a small amount of defect.

Although income can be increased by harvesting your own timber, there are certain other things to consider. You will need equipment as well as some ability in logging, and at least one helper. You will need to plan your farming operation so that you will have time for woods work. The pros and cons of selling stumpage versus selling the cut woodland product can be summed up as follows:

Do your own harvesting if	Sell stumpage if
1. You want to earn the extra money with your labor and equipment.	1. Your time is better occupied otherwise and you don't want the extra money for your labor and equipment.
2. You are skilled at woods work or can obtain skilled assistance.	2. You have no skill in woods work.
3. You have necessary equipment, especially light tractor, power saw, and truck; or if you can team up with neighbors to purchase and share equipment.	3. You have no equipment for logging and cannot justify purchase because of small acreage involved or for other reasons.
4. You have ready markets for logs, bolts, etc. or you can sell timber only if it is cut into the product.	4. Good markets exist for stumpage but markets for products are poor.

Another alternative is to sell products at the roadside. Selling logs at roadside requires only felling, bucking, and skidding equipment. Buyers will often take cut products handy for loading in quantities they would not buy as stumpage. Selling at the roadside will return to the owner all but hauling and part of the business profits normally associated with selling timber.

Mark Trees to Cut and Kill

Whether you cut your own or sell stumpage, trees to be cut should be marked (figure 26). Marking helps you become acquainted with the woods so you know where the good trees are located, how your cut trees are distributed over the area, and about how many cull trees you have. If you desire, the State District Forester (see list in Appendix) for your county will help mark your trees.

Marking trees for cutting or killing is really the heart of good forestry. So far, most of this report has been devoted to telling you how and why certain trees should be cut, killed, or left to grow. This information is basic to the practice of good forestry and should be learned before actual marking begins.

There are at least three good ways to mark trees:

1. Ax: single blaze for trees to be cut and double blaze for trees to be killed.
2. Paint brush with long handle: one spot of paint for cut and two for kill trees.
3. Paint gun: one paint spot for cut and two for kill trees.

Log Harvesting Hints

It is not our purpose to describe in detail how to log but rather to mention a few hints on how to produce better logs and avoid damage to logs and standing trees. Refer to the Northeastern Loggers' Handbook for full details on log harvesting (see list of references in Appendix).

1. Before felling, pick the spot that will cause the least damage to good growing trees and fell the tree in that spot if possible and **if it can be done safely.** Plan the felling so that some trees may be dropped into existing openings but avoid undue damage to young trees of good species. If possible drop trees toward cull trees that should be killed anyway. All damage cannot be avoided but just a thought given to this point will greatly reduce injury to good trees and will pay off in higher future growth.
2. Injury to good growing trees by skidding should also be avoided (figure 27). Simply being conscious of possible injury will cause you to be more careful of your valuable property.
3. Drop trees so they will not break or burst open. A big rock, log or eneven place can easily break a falling tree.
4. Buck up trees to give the best grade of logs. A shorter log free from defects usually has a higher unit value than a longer one with defects included. Buck out bad defects or include them with a log already poor. Better grade logs yield more high-quality lumber, thus they are worth more. Of course, consult the buyer as to his wishes, but try to sell high-quality logs for better prices (see discussion of log quality in Appendix).
5. Cut logs to standard even-foot lengths with a 4-inch trim allowance.

Corn is sold by the bushel and hogs are sold by the pound but forest products are sold in less familiar units (figure 28). The more common forest products, together with their sale units, are as follows:

Sawlogs — Board feet
Veneer logs — Board feet
Stave bolts — Chord feet
Posts — 7-foot piece by top diameter classes
Pulpwood — 160-cubic-foot cord or by the ton
Mine props — Piece, by length and diameter
Piling — Piece, by length and diameter
Fuelwood — Rick, size varies

The estimated number of board feet in a certain log will be different according to the log rule used. The Doyle rule is most commonly used by log buyers in southern Illinois. This rule underestimates the actual cut lumber in all except logs larger than about 26 inches in diameter. The Scribner is more accurate but is rarely used except by the U. S. Forest Service. The International log rule most accurately tells actual lumber yield but it has not yet been widely accepted. A sample comparison of the three log scales for 12-foot logs of different diameters is shown below:

LOG SCALE CAMPARISON

Diameter Small End*	Doyle+	Scribner+	International+
12	48	64	69
16	108	124	131
20	192	204	211
24	300	302	311

* In inches.
\+ In board feet.

Of course, the rule used may not be important if prices are adjusted accordingly. However, before a sale is completed, the owner should know what log rule is to be used in measuring his logs.

Logs or other products are usually measured by the buyer but the manner, time, and place should be agreed upon so that the entire transaction will be fair to both seller and buyer. Because many woodland owners are unfamiliar with the sale units of forest products, they may be at some disadvantage. All terms and units should be clearly understood before the sale. If desired, the landowner can obtain advice from the local State District Forester.

How to Market Forest Products

Marketing is one of the most important aspects of managing a farm woodland. In many cases the money return is less than it should be because of selling practices, lack of understanding of timber values, and limited sales opportunity.

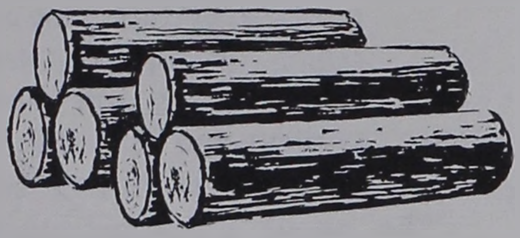
The value of standing timber varies greatly depending on location, species, quality, amount available, and costs of logging and manufacture. Because of these variations it is often difficult to set a fair market price.

What an individual actually receives is also influenced by the demand for timber at the time he is selling. Listed below are a few helpful suggestions on marketing but your own initiative is most important:

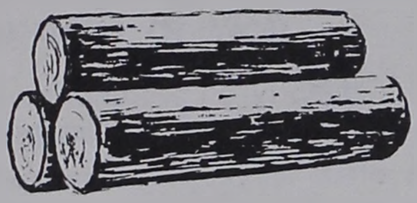
1. Obtain a list of buyers in your locality, if possible; visit each one and become acquainted with him. Before selling allow each interested buyer to quote you a price. Often, because of different needs, efficiency in logging, or nearness to mill, some buyers will offer more than others.
2. Ask your State District Forester for advice (see Appendix).
3. Watch the price trends and sell accordingly. Timber prices vary as do prices for other farm products, although generally not as much. Timber, however, has an advantage because it will keep and there is no pressing need to harvest immediately. Current prices being paid for timber products can be obtained by writing to the Illinois Co-operative Crop Reporting Service, Illinois Department of Agriculture, Division of Agricultural Statistics, Springfield, Illinois, and asking for their "Illinois Timber Products Market Report."
4. Sell only marked and measured timber.
5. Have an understanding regarding the amount of timber that will be bought. A high price per thousand is sometimes deceiving in that the buyer will only take and pay for a small quantity of the highest quality timber returning the owner less money than a lower price with better utilization.
6. Have a written sales contract if possible. This is only a good business practice and often avoids later disputes. Your local state forester can furnish you with a simple but adequate contract form.

Figure 15. Contrast between good and poor cutting practices. **A (above).** A stand of trees 5 years after a heavy improvement cut which left only the good growing trees. **B (below).** A stand soon after a commercial cut which removed all trees merchantable for sawlogs.

Young sawtimber stands immediately after an improvement cut and killing of all culls — about 300 board feet on one acre.



Uncut young sawtimber stands without any forestry practices—about 150 board feet on one acre.



Uncut old sawtimber stands with many mature and over mature trees. No forestry practices used—about 50 board feet on one acre.

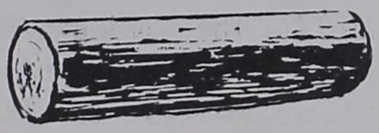


Figure 16. Good forest practices produce rapid growth. The three diagrams represent the actual growth per acre for one year on timber stands in southern Illinois.

7. Consider the formation of co-operative groups of friends and neighbors to make selling easier and to obtain better prices. Co-operative action of this kind is becoming common. It is especially suited to forest products because any one woodland owner in this region usually has rather small amounts to sell. Group selling will place you in a much stronger position and also save the buyer time and expense enabling him to pay a higher price for your material.

The above discussion applies directly to the person selling stumpage although many of the same points apply to the selling of cut products. One main advantage of selling cut products is that there is less uncertainty involved in quantity and quality and a better price is usually obtained.

HOW TO BUILD UP YOUR WOODLAND

Nearly all woodlands in southern Illinois need cutting to remove ripe, poor, and worthless trees, as already explained. This often leaves the stand with thin places or openings. Such a stand of good trees should be built up so that growth rate will be high. The first essential thing, of course, is **protection against fire and grazing.** No woodland will thrive if it is frequently burned or grazed.

Assume we have made a heavy improvement cut, leaving only the good growing trees. Assume further that this stand is thin in places with numerous openings. How does a woodland then build itself up to the proper stocking? Several things happen:

1. The sawlog-sized trees increase rapidly in size and the tops start to fill in the openings cut in the forest canopy.
2. The pole-sized trees also grow rapidly. They fill in some spaces and some take the place of larger trees cut. The tops, in particular, quickly expand to occupy the empty spaces.
3. Saplings and seedlings growing in the opened spaces are quickly stimulated to rapid growth by sunlight.
4. New seedlings sprout and grow in the blank spaces made by cutting.

Then what should be done to hasten and guide this building-up of your woods? There are a few simple rules which will help:

1. Postpone the second and following cuts until the amount to be cut is at least **operable.**
2. In the second and following cuts remove:
   a. Mature trees.
   b. Merchantable trees that have been injured or that have developed some defect so that they are no longer good growing stock.
   c. Kill any new cull trees of all sizes, including smaller trees not wanted because of poor species, form, or defect.
3. The amount cut should be **less** than growth until the stand is built up to the desired point. The following example will illustrate this point:

CUTTING RELATIVE TO GROWTH

Stands	Per Acre	
	Trees (sawlog size)	Board-feet of Sawlogs
Original stand before cutting	38	4,300
Stand left after first improvement cutting	23	2,000
Stand after five years of growth	35	3,700
Amount of second cut	3	600
Stand left after second cutting	32	3,100
Stand after three more years of growth	40	4,200
Amount of third cut	3	600
Stand left after third cutting cutting	37	3,600
Stand after two more years of growth	42	4,500

Note that during a ten-year period, 3,500 board feet per acre were harvested, volume was greater at the end of the period, growth increased, and only good growing trees remained in the stand. Your particular forest might grow at a faster or slower rate. Cutting should be governed accordingly.

What is Good Stocking?

How do you know when your woodland has a sufficient number of trees of various sizes? In general, stocking should not go beyond a certain point because (1) growth will slow

down, (2) more trees will die, (3) the interest rate earned on your investment (in trees) will be lower. There can be no hard and fast rule about good tree stocking. It depends mostly on the quality of the site; that is, good soil will support more trees. The following are suggested guides based on experience and study of unmanaged stands. In all cases the **maximum size of trees is based on maturity goals.**

NUMBER OF TREES PER ACRE NEEDED FOR GOOD STOCKING IN UNEVEN-AGED FORESTS

Site	Pole (5-10*)	Sawlog (11-16*)	Sawlog (17- *)
Uplands			
Coves, streams margins and lower northerly slopes. Breaks along streams in claypan region.	70-90	44-50	8-14
Southerly and upper northerly slopes. Rolling land in claypan region.	70-90	36-42	4-6
Ridgetops and upper southerly slopes. Flat and less well-drained land in claypan region.	60-80	28-34	1-4
Bottom lands			
Well-drained alluvial land with deep soil.	70-90	32-38	14-20
Poorly drained with tight clay subsoil.	70-90	38-44	8-12

* Diameter in inches

When your woodland has reached the stocking given in the chart, the amount cut should be increased to about equal the growth. Growth occurs on all trees. In harvesting we take the equivalent amount in a few selected trees. If growth is 500 board feet per acre per year and you have a 20-acre woodland, the total yearly growth is 10,000 board feet. You could cut this 10,000 board feet every year, cut 20,000 on alternate years, or 30,000 every third year. If you wish to cut every year, it is suggested that you take the 10,000 board feet (or whatever the total growth) from about a third of the woods, then move on to the next third the following year and so on. In that way the cut will be concentrated in a smaller area and it will be easier to make the openings needed for starting new trees

How to Measure Trees to Determine Growth and Stocking

Foresters have accurate but somewhat difficult ways of measuring growth and stocking of a woodland. There probably is no way which is highly accurate and also easy for the average woodland owner or farmer to apply. In small woods the best and simplest way is just to count and measure all the trees. One man can do this work on about seven to ten acres in a day. On larger woodlands, divide the area into two or more **similar** parts and count the trees on one of these parts. Of course, it will be necessary to know the size of the woodland and of any sample part measured so that you can figure on an acre basis. Seek the advice of your State District Forester whenever possible.

For extreme simplicity it is suggested that trees be counted and tallied in a chart like the one below. Good and poor species for different sites have already been listed. Use calipers or a tape to measure the tree diameter (figure 29) but after a little practice you will be able to estimate most trees within a 3-inch range.

SAMPLE TALLY SHEET

(Show number of trees in each space by dots)

Class	Tree Size Diameter (inches)	Good Species	Poor Species
Small poles	5-7		
Large poles	8-10		
Small sawlog	11-13		
Medium sawlog	14-16		
Large sawlog	17-19		
Maturity or near-maturity	20-		

Mark trees as they are counted with a piece of carpenter's chalk or a light hatchet chip in the bark. This count should be made **after** the first improvement cut has been made and the cull trees killed. Do not count dead trees, of course. Repeat check counts should be made every few years on the same areas. You will be surprised how fast the trees increase in size.

How to Find Board Foot Volume

The simple tally described will help you check on stocking and tree growth but will not give you the volume in board

feet. To get this accurately would require an estimate of the number of merchantable 16-foot logs in each tree and the use of a forester's tree volume table (see Appendix). In order to greatly simplify this and at the same time enable you to obtain an approximate idea of the board foot volume in your woods, the following system can be used. If the services of a forester are available, this simplified system would not be needed.

FORM FOR CALCULATING BOARD FOOT VOLUME

Tree Size (diam. in inches)	Number of Trees (by count)	Average Bd. ft. Per Tree (Int. Rule)	Total Bd. ft.
11-13	100	90	9,000
14-16	20	150	3,000
17-19	10	270	2,700
20-22	2	390	780
23-25	1	520	520
Total volume			16,000

Simply enter the number of trees in each size class and multiply by the board feet per tree shown below. This will give the approximate total volume of all trees in each size class.

Because better sites grow taller trees, the average volume per tree will vary by sites. Use the following numbers in figuring volume of your woodland.

APPROXIMATE BOARD FEET PER TREE INTERNATIONAL RULE

Tree size (inches	Sites		
	Upland coves, northerly lower slopes, and well-drained bottom lands	Upland southerly slopes, rolling claypans and poorly drained bottom lands	Upland ridgestops, upper southerly slopes and flat claypan
11-13	90	70	50
14-16	150	120	90
17-19	270	180	140
20-22	390	260	190
23-25	520	350	250

Figure 17. Dense young stand of pin oak below sawtimber size. This stand needs a thinning to save trees that will die and to increase growth of the better trees left. Such thinnings might be used for mine props.

Figure 18. A dense young stand of cottonwood below sawtimber size. Many of these trees will die before they reach mature size for cutting unless the stand is thinned. Such thinning might be used for pulpwood if a market exists.

Figure 19. Stand of pin oak 4 years after about one-third of the trees were removed and sold for mine props. Net growth in this stand was much greater than in the uncut stand shown in figure 17.

Figure 20. These logs and stave bolts represent one year's growth on a 24-acre farmwoods during the early stages of management. After the woodland has been placed in good condition, the annual yield should be 2 or 3 times as much.

Figure 21. Girdling a cull tree. The tree is killed by cutting a V-shaped notch completely around the tree. No live bark must be left uncut or the tree will live.

Figure 22. Methods of poisoning cull tree with 2-4-5,T. The poison is being placed in a frill cut completely around the tree with an axe. The cut should be slanted downward through the bark and into the wood. Poison should be applied so as to drench the freshly cut frill.

Figure 23. A rotten scar caused by a fire 33 years before this photo was taken. This rot may extend a long way up the trunk of the tree and cause the tree to be worthless.

Figure 24. Result of heavy grazing in a farmwoods. Note the lack of seedings and saplings. Woodland grazing provides poor forage. Heavy grazing eventually destroys the forest.

WHAT YOU CAN EXPECT TO EARN

No one can say just what your specific woodland will grow. We do know, however, about what woodlands on different sites in southern Illinois will grow under different conditions. The following chart shows the expected board foot growth per acre per year on the same five site classes used throughout this report:

APPROXIMATE BOARD FOOT GROWTH PER ACRE PER YEAR

Site	Before improvement cutting. Poor trees and culls still present	After improvement cutting but before good stocking built up	After good stocking built up
Uplands			
Coves, stream margins and lower northerly slopes. Breaks along streams in claypan region	150	400	600
Southerly and upper northerly slopes. Rolling land in claypan region.	100	300	400
Ridgetops and upper southerly slopes. Flat and less well drained land in claypan region	50	125	200
Bottom lands			
Well-drained alluvial land with deep soil	300	700	1,000
Poorly drained with tight clay subsoil	150	300	500

As already discussed, the total income from your woodland will depend upon whether you sell stumpage or whether you do part or all of the cutting, skidding, and hauling to the mill. Woods work is simply an opportunity for you to pay yourself wages for labor. If you have a 20-acre woodland growing 500 board feet per acre per year and if stumpage is assumed to be worth $15 per thousand, your **yearly gross** income, depending on method of sale, would average about as follows:

Sell stumpage	— $150
Cut and skid; sell logs at side of road	— 400
Cut, skid, load, and haul to mill	— 500

These are very general figures. Actually a great deal depends upon the quality of the logs. Poor logs cost as much to cut, skid, and haul as do good logs. For the highest quality veneer logs, the tree-stumpage value may be as high as 70 per cent of the delivered value. For some low-quality but operable timber, the stumpage value may be close to zero.

Another way of looking at your woodland is as an investment yielding a periodic interest return in the form of new growth. The per-acre return, especially where stumpage is sold, will be lower than the per-acre return from other farm crops, but the money invested is also much lower. When we consider the wodland from this standpoint, it may return up to 15 or more per cent interest depending on the amount of stocking and the amount of improvement work that is done in the woods. With light stocking, although the interest rate is high, the total return will be less than where a heavier stocking is carried. Since this is true, it is unwise to demand extremely high interest return. What is the interest rate that should be demanded? In general, it is unwise to demand a higher rate of interest from the woodland than an individual could obtain by selling his woodland and putting the money into some other investment of comparable risk open to him.

What you can expect to earn from a wodland depends in large measure on you. If managed, harvested, and sold as other crops it is capable of returning good returns for the thought and effort involved. If handled strictly as an investment, the return again depends upon the owner's demands. Generally speaking lightly stocked woodlands return the higher rates of interest but lower total dollars. Conversely, heavier stocked woodlands return more dollars but at a lower interest rate. It is up to you!

Figure 25. Labor and material values of forest products as percentage of total value at the mill. The market value of timber products represents both labor and material values the same as for other farm crops.

	Return for stumpage	Return for felling and bucking	Return for skidding
Sawlogs	25-40%	10-15%	10-15%
Pulpwood	4-10%	32%	13%
Cabinet-Veneer logs	60-70%	2%	2%

$

Return for oading and hauling	Return as business profits	Value of product at the mill
10-15%	13-20%	100%
26%	18-23%	100%
15-20%	16-31%	100%

IT PAYS

TO DO

YOUR OWN HARVESTING

OF TIMBER PRODUCTS

IT ALL

ADDS

UP

TO

INCREASED

FARM INCOME

Figure 26. Two ways of marking trees for cutting or killing: **A (above).** Marking with a paint gun. Different colors of paint are available. **B (below).** Marking with an axe blaze.

Figure 27. Two types of logging injury to uncut trees: **A (above).** Damage caused by the blade of a crawler-type tractor during skidding. **B (below)** A tree broken off during the felling of a large tree.

A Board Grown is a Dollar Earned

All boards do not cost a dollar each but at retail lumber yards a good-quality, 12-foot board, 8 inches wide, might easily cost $1.00. Growing some of your own wood products needed on the farm is certainly smart farming and will save you money. Some products such as posts, poles, and faced logs can be used without sawing. Most localities have sawmills that will custom saw small lots of logs to your requirements. Trees are a crop that can be both sold on the open market or used on the farm. Generally a combination of these two methods of disposal is the most profitable. Every farm woodland contains some low-value wood in the form of upper logs and tops of trees, poor-quality species, and small trees. Much of this material has little market value, because of the high cost of converting it into useful products, transporting it to market, and the low selling price. However, such material will substitute satisfactorily for a more valuable material in general farm construction. For example, knotty logs may have little market value but when sawed into 1-inch sheathing and partially seasoned they will give just as good farm service as clear boards with a high market value. A guide to good farm use of southern Illinois trees can be obtained by consulting the Appendix.

One farmer in southern Illinois saved $1,120 in out-of-pocket costs by following this practice of using his own woodland. He needed 14,000 board feet to build a loafing shed for his cattle. Lumber quoted at the local lumberyard at that time was 10c per board feet which if bought would have amounted to a total cost of $1,400. Instead of buying this lumber, the farmer selected, cut and hauled to the local sawmill the equivalent amount of lumber in logs. It cost him 2c per foot to have the logs sawed into desired dimension lumber or a total cash outlay of $280 as contrasted to the $1,400 quoted at the local lumberyard. This resulted in a cash savings of $1,120. This, of course, includes stumpage and returns for his own labor and equipment. Home use may be the wisest use of many products of the small woodlands composed of low-quality material.

IS GOOD FORESTRY GOOD BUSINESS?

We have tried to outline how you, the woodland owner, can practice reasonably good forestry. After reading these instructions you may think "so what." You may be skeptical and may have additional questions. The following questions are most frequently asked by landowners and others who are interested in good forestry. Plain answers are given to each question.

1. Question: How do the returns from well managed woodlands compare with returns from cultivated crops?

   Answer: The returns per acre from crops are usually much higher but the amount of work and money investment is also much greater. On the basis of man-hours of work or money invested, good forestry compares more favorably with general farming.

2. Question: Is it true that woodland tracts of southern Illinois are too small to make good forestry pay?

   Answer: No. Small tracts do make economical harvesting and marketing more difficult, but it has been demonstrated that operable cuts can be made on woodlands no larger than ten to fifteen acres. Larger holdings, however, would definitely encourage good forestry. The formation of co-operatives or seller groups would help the owners of small woodlands.

3. Question: Are markets in southern Illinois adequate for all forest products?

   Answer: They are not fully adequate at the present time but many markets do exist. A directory of timber users and buyers in the sixteen southern Illinois counties has been compiled by Southern Illinois University in co-operation with the U. S. Forest Service and can be obtained from the Agriculture Department, Southern Illinois University. In the sixteen southern counties there are at least sixty buyers of sawlogs and ninety buyers of sawlog stumpage. In addition there are at least twenty buyers of white oak stave bolts and stumpage and seventeen buyers of veneer logs

Figure 28. Log scaler measuring a pile of logs. The volume of each log is entered in the scale book.

Figure 29. Two methods of measuring the diameter of trees. **A (above).** Wooden calipers graduated in inches. **B (below).** A steel diameter tape that gives the diameter directly in inches.

and stumpage. There are also several buyers of mine timbers, piling, charcoal wood. The two great marketing needs of the area are (1) organized marketing cooperatives of timberland owners and (2) concentration yards which buy, grade, season, and possibly resaw all kinds of forest products, especially those made from low-grade logs. At present the individual owner should contact several buyers to obtain the best sales contract or obtain the advice of the local State District Forester.

4. Question: Is it true that cuts, and thereby income, from forested lands occur at long intervals?

   Answer: This is true when poor forestry practice is used. With good forestry practice cuts can be made every three to five years on the same woodland. If the tract is split up, cuts can be made every year on some portion of the woodland. The larger the area the heavier and more frequent the cuts can be made. The better the forestry pratice the greater the growth, and the more frequently cuts can be made.

5. Question: Isn't the existing timber of southern Illinois of low quality, low value, and consequently difficult to sell?

   Answer: This is true in part but some good timber still remains and quality can be greatly increased by correct improvement cutting and the killing of cull trees.

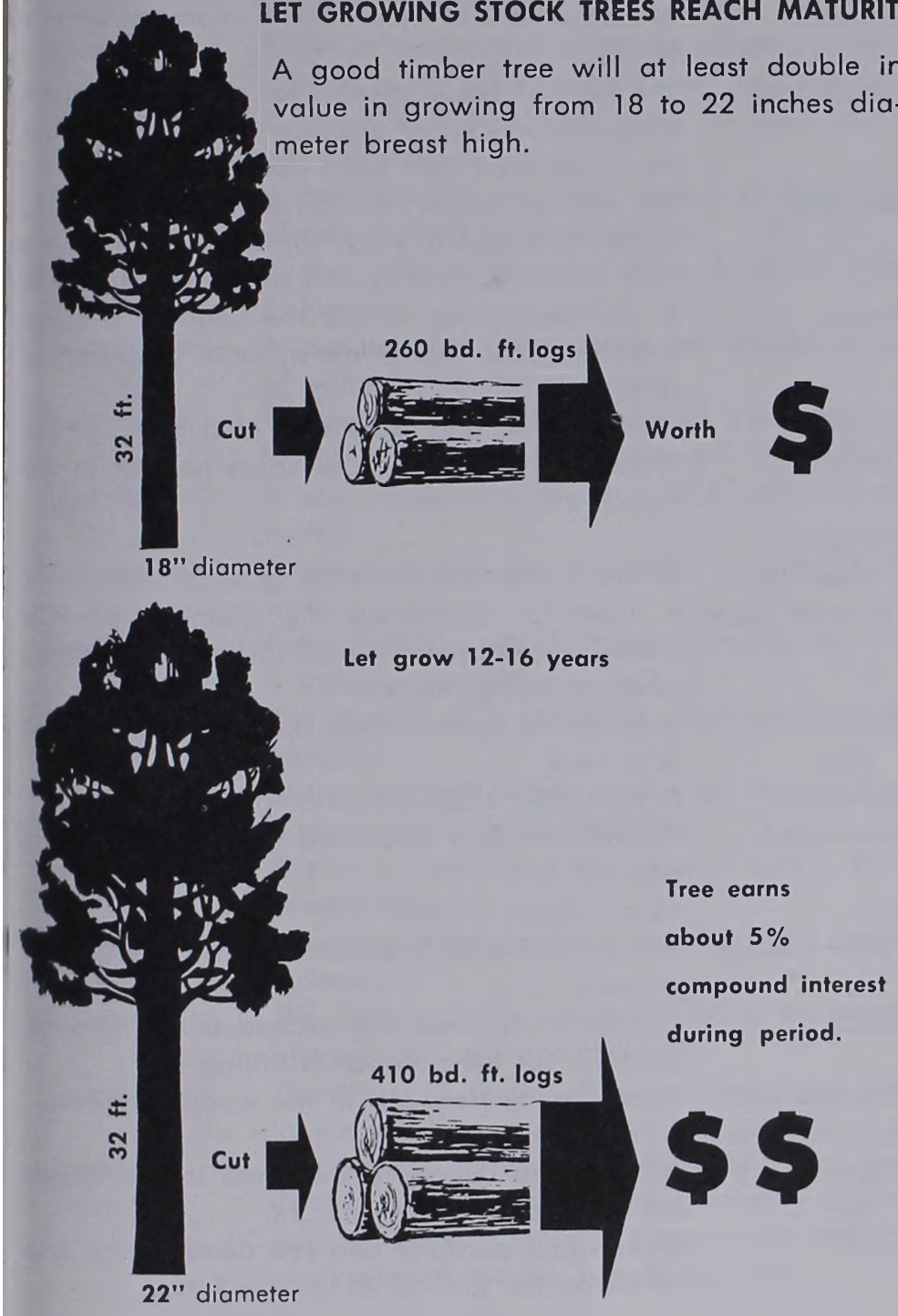
6. Question: Do farmers usually have the proper machinery and equipment for harvesting their own woodlands?

   Answer: Some do and some do not, but most can improvise with available farm equipment or sell stumpage and let the buyer do the cutting. For larger woodlands the purchase of some special equipment such as power saws is justified. Another good solution is custom work or common ownership of logging equipment by groups or co-operatives.

7. Question: What are the future prospects for farm woodland forestry?

Answer: The long-term trend for stumpage and forest products prices is upward. Good lumber is becoming more scarce and the man who has high-quality logs will be in a good bargaining position (figure 30).

Figure 30.


LET GROWING STOCK TREES REACH MATURITY
A good timber tree will at least double in value in growing from 18 to 22 inches diameter breast high.
260 bd. ft. logs
32 ft.
Cut
Worth
$
18" diameter
Let grow 12-16 years
Tree earns about 5% compound interest during period.
410 bd. ft. logs
32 ft.
Cut
$ $
22" diameter

APPENDIX

SIMPLE FORESTRY TERMS USED IN THIS BOOK

Board foot:	The unit of measurement for logs and lumber. It is equivalent to a piece of wood 1 inch thick and 1 foot square.
Bottom land:	Flat land along rivers and larger streams.
Buck:	To saw up a tree trunk into logs.
Calipers:	An instrument to measure the diameter of tree trunks.
Chord foot:	The unit of measurement for white oak stave bolts. It is the chord distance inside bark across the pie-shaped split stave bolts.
Claypan:	Soil with a compact subsoil quite impervious to water. In Illinois it is the flat region north of the hilly southern uplands and south of the prairie.
Cove:	A sheltered valley at the the head of a small drainage with deep, moist, and well-drained soil.
Crown:	The branches and leafy part of a tree.
Cull trees:	A tree which has no sale value now or in the future.
Density of stocking:	Refers to closeness of trees to each other.
Diameter tape:	A tape for measuring the diameter of tree trunks. It is marked to read directly in diameter when encircling the tree.
Diameter (tree):	Diameter of trunk outside bark at breast height (4½ feet).
Dominant:	A tree taller than surrounding trees.
Even-aged:	All the trees in a woodland are about the same age.
Fell:	To cut down a tree.
Forest canopy:	The combined leafy branches of all the trees of a forest.
Girdle:	Cutting a complete ring around a tree through the bark for the purpose of killing it.
Growing stock:	Good quality trees left in the woods to grow.
Harvest tree:	A tree ripe for cutting.
Improvement cut:	A cutting to remove or kill trees in the woods not wanted as growing stock.
Litter:	Broken and partially decayed dead leaves and wood on the ground of a woodland.

Log diameter:	The diameter in inches inside bark at the small end.
Mature tree:	A tree the right size for cutting because the interest rate being earned has fallen below an acceptable point.
Mineral soil:	Clay, silt, or sandy soils; not chiefly decayed plant residue; and not covered with dead leaves or other plant litter.
Operable:	A tree or wodland that can be cut and products sold at some gain to the owner and operator.
Overmature tree:	A tree which has gone past the best size or age for cutting.
Overtopped:	A tree (usually small) or group of trees completely shaded by larger trees.
Pole tree:	A tree with a diameter from 5 to 10 inches inclusive.
Poor risk tree:	A tree liable to early death, windthrow, or loss of value by decay or insects.
Pure stand:	A woodland or large group of trees where at least 80 per cent of the trees are one species.
Sapling:	A small tree from about 1 to 4 inches in diameter.
Sawlog tree:	A merchantable tree 11 inches or over in diameter.
Seedling:	A small tree grown from seed usually less than 1 inch in diameter.
Site:	The quality of a particular place (soil) for tree growth.
Sound tree:	A tree without defect caused by rot or insects in the trunk or large branches.
Sprout:	A tree or shoot that has grown from a stump or root collar.
Stand:	A group of trees growing together on a particular area.
Stocking:	The density of the stand; including the number of trees per acre and their size.
Stumpage:	The trees or their value as they stand uncut in the woods.
Sweep:	The gradual bend or curvature of a tree trunk.
Thinning:	Cutting a portion of the trees (usually in dense young stands) to salvage the products and stimulate growth on the remaining trees.

Timber:	Standing trees in a forest or woodland.
Uneven-aged:	The trees of a stand are of greatly different ages.
Uplands:	Generally all higher lands above the flat bottom lands along major stream courses.
Windfirm:	A well-rooted tree which is not likely to blow over.

LIST OF ILLINOIS STATE FORESTRY OFFICES

Counties served	Headquarters address
Boone, Carroll, JoDaviess, Lee, Ogle, Stephenson, Winnebago	Ogle County National Bank Building, Oregon (Box 51)
Bureau, Henry, Knox, Marshall, Mercer, Putnam, Rock Island, Stark, Whiteside	108 W. Exchange Cambridge (Box 85)
Adams, Brown, Hancock, Henderson, Warren, McDonough, Schuyler	62 Madison Street, Carthage (Box 41)
Cass, Fulton, Logan, Mason, Menard, Peoria, Tazewell, Woodford	301½ West Main, Havana (Box 107)
Calhoun, Greene, Jersey, Morgan, Pike, Scott	State and Pearl Streets, Jerseyville (Box 177)
Bond, Christian, Fayette, Macoupin, Madison, Montgomery	102 North Main Hillsboro (Box 582)
Clark, Coles, Cumberland, Douglas, Edgar, Effingham, Moultrie, Shelby	701 Monroe Street, Charleston
Clay, Crawford, Edwards, Jasper, Lawrence, Richland, Wabash	South Fair Street Olney (Box 256)
Jefferson, Franklin, Hamilton, Marion, Wayne, White	Benton Forestry Headquarters (2 miles North Benton, Route 37) (Box 183, Benton)
Clinton, Monroe, Perry, Randolph, St. Clair, Washington	119A W. Broadway Sparta (Box 21)
Alexander, Jackson, Johnson, Pulaski, Union	1006 Walnut Street, Murphysboro (Box 636)

Gallatin, Hardin, Massac, Pope, Saline, Williamson	15½ North Main, Harrisburg (Box 444)
Sangamon and others	303 East Monroe Street Springfield

VIGOR CHARACTERISTICS OF TREES

	Good vigor	Poor vigor
Growth	Usually less than 12 growth rings per radial inch of wood.	From 15 up to 25 or more growth rings per radial inch of wood.
Crown	Full, dense, and well-balanced. Not competing closely with other crowns. No major dead limbs.	Small, thin, and poorly balanced. Competing closely with other crowns, major limbs dead or dying, broken or dead limb stubs.
Main Trunk	Sound, upright, no defects.	May have evidence of decadence as shown by starting decay, holes, bulges, or rotten branch stubs.
Rooting Bark	Well anchored. In white oak fissures are long, ridges flat, and there are few cross breaks in ridges. Bark is dark gray and soft in texture. Black, red, and scarlet oaks and hickory have conspicuous new bark in shallow fissures. Yellow - poplar has new light-colored bark in sharp V-shaped fissures.	May be root-sprung. In white oak fissures are shorter and less distinct and there are many cross breaks in the ridges. Bark is lighter colored and tends to be hard. In black, red, and scarlet oaks and hickory there is little new bark evident in the usually deeper fissures. Yellow-poplar has little new bark evident in the deep fissures. Bark is thick with ridges.

BOARD FOOT VOLUME OF TREES BY DIAMETER AND NUMBER OF 16-FOOT LOGS

(International Rule, Form Class 76)

Tree Diameter Inches	Number of 16-foot Logs						
	1	1 ½	2	2 ½	3	3 ½	4
11	43	56	70	---	---	---	---
12	52	68	85	98	---	---	---
13	63	84	104	120	136	---	---
14	74	99	124	143	162	---	---
15	87	116	146	170	194	210	---
16	100	134	169	198	226	246	267
17	114	154	195	228	262	286	310
18	129	175	221	259	297	325	353
19	146	198	250	294	337	369	401
20	162	220	279	328	377	413	449
21	180	246	312	367	422	463	504
22	198	271	344	406	467	514	560
23	218	299	380	448	517	568	618
24	237	326	415	491	567	622	676
25	260	359	458	542	626	688	751
26	284	392	500	592	684	755	826
27	308	425	542	644	745	822	898
28	331	458	585	696	806	888	971

PRIMARY PRODUCTS FROM SOUTHERN ILLINOIS TIMBER

Product	Species used and general description of product
Sawlogs	All species if sufficiently large. Sizes vary but generally must be at least 8 inches in diameter inside bark on the small end of the log and at least 8 feet long.
Cabinet veneer logs	Walnut, white oaks, red oaks, yellow-poplar, sweetgum, and sometimes others. Usually must be at least 16 inches in diameter inside bark on the small end of the log, and nearly free of knots, mineral stains, crooks, or other blemishes.
Container veneer logs	Sweetgum, yellow-poplar, cottonwood, and sycamore preferred. Sometimes also use soft maple, elms, willow, hackberry, birch, ash, and blackgum. Must be at least 14 inches in diameter inside bark on the small end and 10 feet long. Excessive knots and other defects disqualify logs for this use.
Tight co-operage stave and header bolts	White oaks except post oak. Upland white oak preferred. Must be at least 12 inches in diameter on the small end inside bark. Intermediate in quality between veneer logs and sawlogs.
Piling	All species except such soft hardwoods as willow and cottonwood. Must be straight and sound. Minimum diameter inside bark 6 to 8 inches. Minimum length 16 feet, longer lengths preferred.
Pulpwood	Chiefly soft hardwoods such as cottonwood and willow. Cut into 5-foot lengths. Maximum diameter around 8 inches, minimum diameter around 3 inches. Larger trees must be split.

Mine props	Hard hardwoods, preferably oaks. Lengths range from 3 feet 10 inches to 10 feet and tip diameter inside bark from 3 inches to 8 inches.
Untreated fence posts	Black locust, redcedar, osage orange, and post oak are chief species used. Sizes vary but usually 7 feet long with minimum tip diameter inside bark of 3 inches. Round posts preferable.
Treated fence posts	If properly treated with a preservative to prevent rot, any available species can be used.
Fuelwood	All species; hard hardwoods preferred, sizes vary.

Species	HOUSES																			BARNS AND BUILDINGS								MISCELLANEOUS										
	Exterior Trim	Flooring	Kitchen Flooring	Porch Flooring	Framing	Interior Trim, Nat. Fin.	Interior Trim, Painted	Lath	Roof Boards (Sheathing)	Sash	Sash(Moist Location	Shelving (Nat. Fin.)	Shelving (Unf. or pa.)	Shingles	Siding	Sub. Floors	Wall Sheathing	Joists, Rafters, Plates	Mangers	Roof Boards, Sheathing	Siding	Sills on Foundation	Stall Flooring	Stanchions & Stalls	Studding	Concrete Forms	Fence Posts	Gates and Fences	Scaffolds	Silos, Tanks, Vats	Troughs and Supports	Windmill & Well Plat.	Bridges	Wagon Boxes	Hay Racks	Handles	Tongues
Ash — White and Green					1	1	2		1			1				1		1	1			3	1	2	2				1						1	1
Redcedar	1					2				1				1	1		1	3			1	1					1	2		1						
Cottonwood									3							3	2	3		2						3	*						1			
Baldcypress	1	2		1		2		2	1	1	1	2	1	1	1	1	1	2	2	1	1	1	2	3	1	1		1	2	1	1	1	2	1		
Elm — Red			3		2				1							2		2	1	3		2	1	1	2		*		2					2		2
Elm — American					2				1							2		2	1	3		2	1	2	2		*		2							
Gum — Red					3	3	2											2	1	3			2	2	2	3	*	3						2		
Hackberry			3						1							2		2							2									2		
Hickory																			1					2			*							1	2
Locust — Black				2															1				1	1	2		1				1			1	
Maple — soft			3				2									2										3									
Oak — Red and Black		1	1		1	1			1			1		2		2		1	1	2		3	1	2	2	3	*	3	2			1		2		2
Oak — White and post		1	1	1	1	1					2	1						1	1	3		1	1	1	2		1	1		1	1	1	1	2		2
Yellow - poplar	1						1	1	2			2	1		2	1	1	2	2	3	2				2			2		1			1			
Sycamore			3		3	1												2				3			2											
Walnut						1	1					1															1									
Osage Orange																											1								

GUIDE TO FARM USE OF SOUTHERN ILLINOIS TREES

Legend: 1—Excellent; 2—Very good; 3—Satisfactory (Adapted from USDA Bulletin 1756).

*Fence posts of these species give excellent service provided they are given thorough preservative treatment.

IT PAYS TO GROW HIGH-QUALITY LOGS

One objective of good woodland management is to promote and maintain a high yield of wood products. A less obvious but equally important objective is to produce this yield from high-quality trees.

1. It pays to grow **good** trees.
   a. A mill man can expect only 65 to 75 per cent as much return from oak lumber cut from grade 2 logs as from grade 1 logs.
   b. A mill man can expect only 50 to 60 per cent as much return from oak lumber cut from grade 3 logs as from grade 1 logs.
2. It is wasteful to harvest **good** trees too soon.
   a. A butt log, even if perfectly clear, must be at least 13 inches in diameter, inside bark small end, to qualify as grade 1.
   b. A top log, even if if perfectly clear, must be at least 16 inches in diameter, inside bark small end, to qualify as grade 1.
   c. Any log, even if perfectly clear, must be at least 10 feet long to qualify as grade 1.

COMPARATIVE YIELDS OF LUMBER CUT FROM GRADES 1, 2, AND 3 HARDWOOD LOGS*

Grade Lumber	Market Price per Thousand bd. ft.†	Lumber Grade Yield by Log Grade Per Thousand Bd. ft. Boardfeet Grade 1	Grade 2	Grade 3
FAS	$175	280	60	10
No. 1C	95	390	380	220
No. 2C	70	130	210	270
No. 3C	45	200	350	500

*Log-grade information included in this table is based upon Forest Products Laboratory Report No. D1737, "Hardwood Log Grades for Standard Lumber."

†Average prices (F.O.B. Texas and Louisiana mills) quoted in September, 1954, for plain sawn, air-dried, 4/4", red oak lumber.

PLACES TO FIND ADDITIONAL INFORMATION

Growing Timber Crops

1. Dollars and Sense in Conservation by S. V. Ciriacy-Wantrup
   Circular No. 402. California Agr. Expt. Sta.,
   Berkeley, California
2. Forest Planting Practices for Illinois
   Illinois Technical Forestry Association,
   Office State Forester, Dept. Conservation, Springfield, Ill.
3. Forestry on Private Timberlands
   Miscellaneous Pub. No. 381, U. S. Dept. of Agriculture,
   Supt. of Documents, Washington, D.C. Price 10 cents.
4. Management of Bottomland Hardwoods by John A. Putnam
   Occasional Paper No. 116, Southern Forest Expt. Station,
   New Orleans, La.
5. Managing the Small Forest
   Farmer's Bul. No. 1989, U. S. Dept. of Agriculture,
   Supt. of Documents, Washington, D.C.

Harvesting and Using Timber Crops

1. Cutting and Logging Equipment for Farm Forestry Work by
   C. W. Simmons, Texas Agr. Ext. Bul. No. 137
2. Home Grown Lumber for Farm Buildings by F. E. Winch
   Cornell Agr. Ext. Bul. No. 747
3. How to Prepare Pulpwood by F. T. Murphey
   Penn. Agr. Ext. Cir. No. 244
4. Marketing the Farm Forest Products of Southern Illinois by
   O. Keith Hutchison and Robert K. Winters
   Tech. Paper No. 123, Central States Forest Expt. Station,
   Columbus, Ohio
5. Northeastern Logger's Handbook by Fred C. Simmons
   Handbook No. 6, U. S. Dept. Agriculture,
   Supt. Documents, Washington, D.C. Price 75 cents
6. Preserve your Posts with Penta by C. S. Walters.
   Univ. of Ill. Agr. Ext. Cir. No. 636
7. Southern Illinois Timber Markets by John F. Hosner
   Southern Illinois University

In 1950 Southern Illinois University and the Central States Forest Experiment Station, U. S. Forest Service, agreed to start co-operative forest research and demonstration projects. The early projects were directed toward determining and demonstrating improved methods for growing timber. More recently the University-Forest Service team has expanded its co-operative activities to include harvesting, utilizing, and marketing forest products.

Throughout the past five years this co-operative program has resulted in several publications. Those issued previous to this one are:

(1) Deitschman, Glenn H. and Neckers, J. W.
1953. Identification and occurrence of sulphides on land stripped for coal. Cent. States Forest Expt. Sta. Tech. Paper 136, 21 pp., illus.

(2) Herrick, David E.
1955. Skidding resistance in hardwoods. Northeast. Logger 4(1): 16-17, 37, 48-49, illus.

(3) ----------
1955. Tractive effort required to skid hardwood logs. Forest Prod. Jour. 5(4): 250-255, illus.

(4) Hosner, John F.
1952. Wood markets for southern Illinois. South. Ill. Univ. Agr. Dept., 39 pp.

(5) ----------
1952. Southern Illinois timber markets. South. Ill. Univ. Agr. Dept., 33 pp.

(6) ---------, and Lane, Richard D.
1953. Making farm woodland improvement pay. Cent. States Forest Expt. Sta. Tech. Paper 133, 12 pp., illus.

(7) Hutchison, O. Keith and Winters, Robert K.
1951. Marketing the farm forest products of southern Ilinois. Cent. States Forest Expt. Sta. Tech. Paper 123, 39 pp., illus. (published by Southern Illinois University)

* Out of print.

(8) Kaeiser, Margaret.
1955. Frequency and distribution of gelatinous fibers in eastern cottonwood. Amer. Jour. Bot. 42(3): 331-334, illus.

(9) _____ and Stewart, Kenneth D.
1955. Fiber size in **Populus Deltoides** Marsh. in relation to lean of trunk and position in trunk. Torrey Bot. Club Bul. 82(1): 57-61, illus.